kilometers, 33.3 kilometers, 25 kilometers, and so on: while if the height were different the whole series would be different. We have here, therefore, another possible explanation of the fact that both with damped and undamped waves it has been observed that at certain times certain wave lengths are more easily transmitted than others. I would suggest that, although this may be due to interference of direct and reflected waves, it may also be due in part at least to a change in the height of the shell, whereby the natural resonance wave lengths of the terrestrial oscillator are altered.

RAINFALL AFTER BATTLE.[1]

By GEN. H. M. CHITTENDEN, U. S. ARMY.

[Dated Port of Seattle, Seattle, Wash., October, 1914.]

To the Editor: I noted in the Post-Intelligencer [of Seattle, Wash.] an extract from Pearson's Weekly (London) in regard to the effect of battles in producing rain. There seems to be an almost universal belief in a direct relation between these two phenomena. Several years ago, in preparing a paper on the influence of forests on streamflow, I had a great deal of correspondence with Col. T. P. Roberts, of Pittsburgh, a brother, I believe, of Prof. Milnor Roberts, of our university [University of Washington, Seattle]. Col. Roberts called to my attention the fact that this belief in the effect of battles was prevalent in the days of the Roman Empire, and cited a paragraph from Plutarch to that effect. The matter seemed so interesting to me that I inserted it in the form of the following footnote in my paper:

Though admittedly irrelevant, the interesting character of the following item justifies its insertion here, as another example of the old saying that "there is nothing new under the sun." Everyone is familiar with the superstition (possibly it deserves a better name) that great battles produce rain. The vibrating effect upon the atmosphere of the multitudinous detonations of artillery is generally ascribed as the cause. Read this from Plutarch, who flourished 45–125 A. D.: "It is an observation also that extraordinary rains pretty generally fall after great battles; whether it be that some divine power thus washes and cleanses the polluted earth with showers from above, or that moisture and heavy evaporation, steaming forth from the blood and corruption, thickens the air, which naturally is subject to alterations from the smallest causes."

The fact that this belief is thousands of years old and antedates by at least a thousand years those physical causes (artillery bombardments) which are now the explanation assigned to this assumed relation, demonstrates how uncertain the relation itself is. The recent occurrences in France furnish no proof of the theory. There have been considerable spells of both fair and rainy weather, though conditions as to artillery practice were practically the same. On the basis of actual demonstration, therefore, it must be admitted that the theory does not have much to stand on.

Even if it were an established fact that heavy detonations or bombardments tend to condense the moisture of the atmosphere and cause precipitation, its value in a practical way would still be very questionable. When the atmosphere is well charged with moisture, natural causes lead to its condensation to an extent which probably satisfies the average need for it. Artificial rainmaking is not required at such times, but only in seasons of drought, when Nature's efforts in that direction seem to be suspended. But the power to produce rain at such times, even admitting its efficacy at others, fails because there is nothing to make rain of. No matter how efficient the pump, one can not pump water when the well is dry. So we are thrown back upon the greater problem of getting an atmosphere laden with moisture, and over this matter man has no more control than he has in restraining a surcharged atmosphere from spilling its moisture too rapidly and causing great floods.

[1] Published in the Seattle Post-Intelligencer of Oct. 5, 1914, and later revised by the author for the MONTHLY WEATHER REVIEW.

THE HOURLY FREQUENCY OF PRECIPITATION AT NEW ORLEANS, LA.

By EDWARD D. COBERLY, Local Forecaster.

[Dated Weather Bureau, New Orleans, La., Sept. 1, 1914.]

While the precipitation at New Orleans during the greater portion of the year perhaps does not differ materially, either in amount or in frequency of occurrence, from that at other stations along the Gulf coast from Florida to Texas, the rainfall during the months of June to September, inclusive, does possess certain characteristics which distinguish it very distinctly from that of other localities in the area mentioned. With a view to bringing out these peculiar characteristics of the summer precipitation at New Orleans, a study of the hourly amounts of precipitation and also the frequency of the precipitation during the different hours was undertaken, covering the period for which the hourly records are available at New Orleans, namely, 1905 to 1913, inclusive. The data collected in this connection have been summarized in a table which shows the number of times during each hour, for the entire period covered, that precipitation of 0.01 inch or more occurred, and in four charts showing graphically the diurnal march of the frequency of the precipitation for each month of the year.

As a glance at the chart (fig. 1) will show, from October to May, inclusive, the precipitation is very evenly distributed throughout the 24 hours, there being no marked excess in the number of showers at any particular period of the day. In June, however, and extending through September, the tropical characteristics of the rainfall become very marked, and 60 per cent of all the hours with rainfall occur from 10 a. m. to 6 p. m. and 40 per cent between the hours of 12 noon and 4 p. m. The greater portion of this summer rainfall occurs as the accompaniment of local thundershowers, which are recorded on an average of nearly half the days during the four months June to September, being most frequent in July and least frequent in September. The distribution of barometric pressure most favorable to these daytime thundershowers is an area of high pressure centered on the south Atlantic coast and gradually diminishing in intensity westward toward Texas. The frequent occurrence of these convectional rains in southeastern Louisiana, and especially in New Orleans and its immediate vicinity, is no doubt materially increased by the topographical surroundings of the city. It is almost entirely surrounded by water, thus giving to its summer climate a great many of the characteristics of a semitropical island, that is, clear weather during the night and early morning hours, rapidly increasing cumulus clouds during the forenoon, culminating in showers during the warmest hours of the day, together with an absence of great extremes of temperature.

The hour of greatest precipitation appears to become progressively later in the afternoon as the season advances, the period of most frequent rainfall in June being 1 p. m. to 4 p. m., there being not much variation in any of the afternoon hours; in July it is 1 p. m.; in August, 2 p. m.; and in September, 3 p. m.

That the summer rainfall at New Orleans is markedly influenced by its topography is shown by a comparison of the number of days on which 0.01 inch or more of precipitation occurs at New Orleans, with the same records at other stations located along the Gulf coast, but not so nearly surrounded by water. For the purpose of this comparison, the records of New Orleans and Lake Charles, La., Pensacola, Fla., and Galveston, Tex., have been chosen, and it is found that the average number of rainy days for the four months considered is as follows: New Orleans, 53; Lake Charles, 34; Galveston, 36; and Pensacola, 47.

A study of the intensity of the hourly rainfall was also made, but the short period covered by the records and

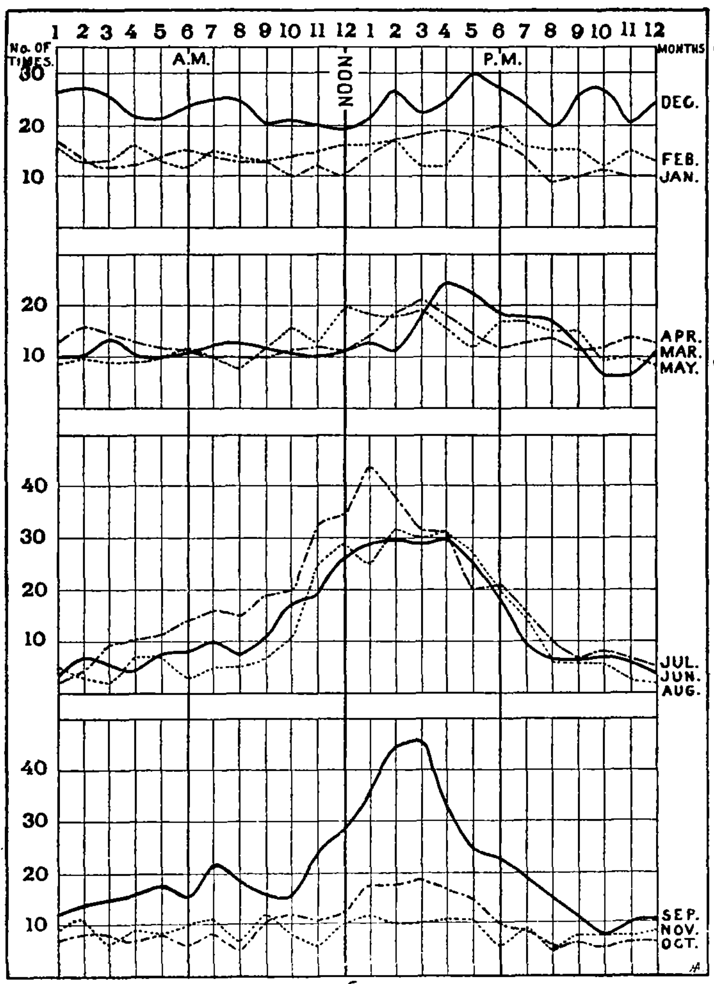

FIG. 1.—Curves of hourly frequency of precipitation at New Orleans, La., for each month (1905–1913).

the possibility of the occurrence of excessive rainfall during any hour render it impossible to draw any conclusions as to the hour of most intense precipitation.

It is believed that a study of the hourly precipitation records, especially a study of the frequency, will open up a new field for the use of Weather Bureau records, because contractors, engineers, agriculturists, and others whose occupations necessitate their working out of doors would, by means of these hourly frequency data, be enabled to arrange their work and that of their employees, so that it would be performed during those hours when there is the least likelihood of its being interrupted by rainfall, and in this way, perhaps, a great deal of valuable time would be saved, not to speak of the saving of damage suits, etc., on account of baggage, produce, and other articles being injured by dampness when being transferred at a time of the day when there is more probability of rainy than of dry weather.

The table and charts are appended in order that those who may care to do so can have the exact information at hand and can draw their own conclusions.

TABLE 1.—*The number of times 0.01 inch or more of rain was recorded at New Orleans, La., during 9 years, for each hour of the 12 months.*

Months.	A. M.—Hours ending at—											
	1	2	3	4	5	6	7	8	9	10	11	Noon.
January	17	13	12	12	14	15	14	13	13	10	12	10
February	16	13	13	16	13	12	15	14	13	14	15	16
March	10	10	14	10	10	11	13	12	11	11	10	11
April	13	16	15	13	12	11	10	10	10	11	12	11
May	9	10	9	9	10	11	10	8	12	16	13	20
June	3	7	5	4	8	8	10	7	11	18	19	27
July	2	4	9	10	11	14	16	15	19	20	33	34
August	5	3	2	7	7	3	5	5	7	11	25	29
September	12	14	15	16	18	15	22	18	16	15	25	28
October	7	8	8	7	8	6	9	5	11	12	11	12
November	9	11	6	9	8	10	11	7	12	8	6	10
December	26	27	26	21	21	24	25	25	20	21	20	19

Months	P. M.—Hours ending at—											
	1	2	3	4	5	6	7	8	9	10	11	Mid't.
January	14	17	18	19	18	17	14	9	10	11	10	10
February	16	17	12	12	19	20	16	15	15	12	15	13
March	13	11	19	25	22	18	18	17	12	6	6	11
April	14	19	21	18	14	12	13	14	11	12	14	13
May	19	18	19	16	12	17	17	15	15	9	10	8
June	29	30	29	30	25	18	9	6	6	7	6	4
July	44	38	31	31	20	21	16	10	7	8	6	5
August	25	32	30	31	27	20	15	6	6	6	3	2
September	37	45	46	32	24	23	19	15	12	8	11	11
October	18	18	19	17	15	10	9	6	7	6	7	7
November	12	10	10	11	11	6	9	6	8	8	8	9
December	21	27	22	24	30	27	24	19	26	27	20	24

DROUGHT VERSUS IRRIGATION.

Many years ago the MONTHLY WEATHER REVIEW called the attention of our numerous observers and correspondents to the importance and possibility of providing beforehand for the supply of water that would be needed in the long droughts to which this country is subject. Of recent years everyone has heard of the droughts and the disastrous loss of crops in that western region that in 1850 was known as the "great American desert." The great progress that has been made since those days has enabled western agriculturists to diminish the danger of a disaster from droughts; indeed, by the help of the Reclamation Service they are turning deserts into gardens. But meanwhile we must repeat our advice of years ago, which seems especially applicable to New England and the Middle States, to the effect that it is not necessary for a farmer to be at the mercy of droughts and uncertain local rains. A drought of 30 days during June or July or August may be as injurious in the Atlantic States as anywhere else, and yet experience shows that an abundance of water is available at a short distance below the ground. A recent Farmers' Bulletin, No. 592, of the Department of Agriculture, although it appears to be specifically intended for western grazing lands, contains abundance of good suggestions applicable to the Atlantic States. Deep bored wells and springs often furnish sufficient water for local crops and cattle if only it is used economically. The expense of a well and pump is saved in one or two years by the resulting increase of